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Editorial – Comments About a Few Words in the Biological Sciences

Editors, perhaps to a greater extent than most individuals who are interested in literature, find word usage a subject for serious consideration, from which they derive both pleasure and pain. An editor may develop concepts of the meanings of certain words, or about how certain words should be used, with his notions differing from those that seem generally accepted. These concepts are expressed in modifications to those manuscripts that an editor is invited to consider for publication in his journal.

Of course, each editor is convinced that his concepts are correct and at least worthy of attention, if not emulation, by others. This is the thought that has impelled me to list in alphabetical order and discuss some of the words that seem to me to be commonly mis-used in biological literature generally, and especially in the literature of systematic biology. Because I am a systematist, I have also listed some commonly used words that I think are inappropriate in writing about systematics.

ALWAYS (antonym - never). – I think it's best to avoid this word and its antonym in writing about fields that rely mainly on observation for information about nature, and hence are mainly inductive. Further, does the statement "prolegs are always absent" mean anything different from "prolegs are absent"? Unqualified, "absent" means just that. I suppose "always" gives emphasis to the adjective, but this seems unnecessary.

ANATOMY. – This word refers, literally, to dissection. It is not a synonym of morphology (study of structure and form) except by virtue of careless usage. Neither should it be used as botanists and some entomologists do: that is, to refer to internal structures and organs. I suppose this unfortunate usage developed because one must dissect (anatomize) to examine internal organs. The noted arachnologist, T.H. Savory wrote (Browsing Among Words of Science, 1951, page 67): "we read of . . . external anatomy, which if it means anything can only mean shaving; and of comparative anatomy, which ought to be a contrast between the use of scissors, scalpels and saws . . . ." Why not use the simple terms "external structure" and "internal structure" when referring to these aspects of morphology? See also MORPHOLOGY, below.

BIOLOGY. – This is a term that refers to a field of human endeavor. It means "study of life". It seems to me utterly incorrect to use "biology" for the non-morphological, non-classificatory portions of the general field. By implication then, morphology and systematics are excluded from biology, and in turn, morphologists and systematists are not biologists!

An organism or group of organisms cannot have *a* biology. An organism has a life, and study of its life (in the broadest sense) is the domain of biology.

Rather than entitling that section of a systematic treatment "Notes on Biology" that deals with some special aspects of the living members of a particular taxon, it's best to be more specific, and more accurate. If the notes deal with host associations, then use these words for the title; if they deal with habitat and life history, then use these words for the title.

CASE (synonym - situation), as used in the expression "in this case". – I doubt that this phrase need be used outside the literature of the legal profession or the brewing or cartage industries. More specific expressions are available for biological literature.

CLASSIFICATION. – See TAXONOMY.

DIVERGENCE. – This term should be used to express relative amount of difference among taxa. One group, whose members are removed by appreciable structural differences from members of other taxa, is said to exhibit marked divergence, or to be highly divergent. A higher taxon whose member taxa exhibit considerable difference from one another is said to be highly divergent in comparison with another taxon whose member taxa show slight differences. See also DIVERSITY.

DIVERSITY. – This term is best restricted to reference to numbers of members of groups (either individuals or taxa, or both). A higher-ranking taxon including many lower-ranking taxa is highly diverse, but some exhibit slight divergence. On the other hand, some highly divergent taxa exhibit low diversity. In any event, it's best to refer to inclusiveness of a taxon in terms of amount of diversity or words implying this (that is, "this genus includes few (or many) species"), rather than as "large" or "small". These latter terms deal with size, too, but the context is different. Also, as these words are used, a "large genus" can be either one including many species, or one that includes species whose members are of large size.

DIVISION. – This is not an appropriate word to describe the actions of systematists with reference to taxa. Activities include grouping, re-grouping, and arranging. Re-grouping of species that results in more genera than were previously recognized seems to be described appropriately by the word division, but it is not the same thing as, say, cutting a pie, which has a high degree of physical continuity, or cutting a piece of string. Of course, dissection is a form of division, and when a biologist makes a dissection he is indeed dividing.

LARGE (as applied to taxa). – See DIVERSITY.

MAY. – As used with reference to occurrence or non-occurrence of characters among members of a taxon, this word is inappropriate. In fact, in each instance, a given character state *is* or *is not* exhibited. So, rather than writing "structure X may be present", it's better to write "structure X is present in a few individuals; it is absent from most".

MORPHOLOGY. – Means *study* of form and structure. An individual (not a taxon) has a particular structure, or a particular combination of structures. It does not have *a* morphology. As with the term "anatomy", what can "external morphology" possibly mean: "the external study of form and structure"? When referring to parts of a particular organism, the word *structure* is adequate, and does not need the embellishment of the word morphology.

NEVER. – See ALWAYS.

OCCASIONALLY (related words - rarely, sometimes, usually). – This word is not appropriate in description of distribution of static characters states among taxa. What is implied by most authors is that a particular character is represented by more than one state, and expression of the less frequent one is described as *occasional*. It is best to indicate the matter more precisely,

without reference to time, as follows: "members of most species with red antennae, those of a few species with black antennae"; in preference to "antennae usually red, occasionally (or sometimes, or rarely) black".

On the other hand, if antennal color of an individual changes periodically and is *usually* red, then it would be *occasionally* (or sometimes, or rarely) black.

RARELY. — See OCCASIONALLY.

SMALL (with reference to taxa). — See DIVERSITY.

SOMETIMES. — See OCCASIONALLY.

SPECIES (and other taxa). — These have members, which are represented by eggs, immatures, or adult males and females. These members have characters — structural, behavioural, ecological, genetical, physiological, and so on. Species and other taxa *do not* have characters. Thus it is incorrect to write that "A few species deposit their eggs in the nests of other bees", or that "the aedeagus of this species has a knob on the distal end". Rather, one should write that "Females of a few species deposit their eggs . . . " *et cetera*; or that "aedeagi of males of this species" . . . *et cetera*.

SYSTEMATICS. — See TAXONOMY.

TAXONOMY. — This is the general term for study of the principles of classification, application of the principles to formation and ranking of formal groups (taxa), and naming the taxa.

Systematics is the field of organic diversity, and taxonomy is a portion of this field.

Classification is used in two senses: 1. for the process of establishing taxa; 2. for the resulting formal system of arrangement. Thus, one classifies as one constructs a system. The system is a classification.

I doubt that it is correct to write, as the title of a paper: "The *Taxonomy* of the Genus *X-us*". Genus *X-us* does not have *a* taxonomy. Rather, its species are arranged, or classified in a particular way, according to taxonomic principles.

The word taxonomy also seems to me to be mis-used with reference to study of an existing classification for the purpose of learning to identify specimens. This type of activity is not taxonomy.

TECHNOLOGY. — This word must mean "study of techniques". It is used by many writers and speakers in place of technique, so that even the most mundane and inconsequential of procedures is given some aura when it is referred to as a technology!

THE. — Categorical expressions (as implied by use of "the") are to be avoided with reference to selected individuals. For instance, vertebrate physiologists commonly use the expression "the rat" in published work, when what is meant is groups of rats of the species *Rattus norvegicus* on which some experiments have been conducted. *"Rats"*, if a more modest expression than the categorical *"the rat"*, is also a more accurate expression.

UNIQUE. — Because members of each taxon have some unique features, it is inappropriate to state that a given taxon is unique without specifying in what way this is so.

USUALLY. — See OCCASIONALLY.

VARIABLE. — This means that a feature of an *individual* has the capacity to exhibit variation. However, in descriptive writing, what is meant by most authors is that a particular character is expressed in one or more states. Each state is either expressed or not expressed in a given individual, and is non-varying therein. Hence, it seems preferable to use "varied", or "various". For example, I prefer: "The general form of beetle larvae is widely varied" rather than " . . . form of beetle larvae is variable". To me, the second expression implies that a given individual at different times might be compodeiform, scarabaeiform, and eruciform. Of course, when one writes about larvae of meloid beetles (and larvae of some other groups, too), "variable" is indeed the word of choice, because form of an individual larva changes markedly during development.

Examples of uses of many of these words that are counter to my present views are in my earlier publications. Hopefully, these past actions will not be held against me, or used to negate my arguments! I invite the readers of Quaestiones Entomologicae to consider not only my views on the use of these words, but also the more general question of economy and accuracy of written expression of observations and ideas. I'll be pleased to receive comments about these matters.

George E. Ball